

REMARKS

Reconsideration of this application is respectfully requested in light of the above amendments and following remarks. Claim 3 remains cancelled without prejudice or disclaimer. Claims 1 has been amended to expedite the issuance of claims of particular current licensing interest. Claims 1, 2, and 4 – 18 are pending in this application. Claim 1 is the independent claim.

I. No Prima Facie Case of Obviousness Has Been Presented

Claims 1, 4, 5 and 13-18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Vandik, either alone or in combination with Conti (U.S. Patent No. 4,777,654), or Bates (EP Patent Application No. 0050393). This rejection is respectfully traversed.

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s disclosure.” *See* MPEP § 2143.

Each of claims 2 and 4 – 18 depends from claim 1, which recites “wherein the tunable dielectric layer comprises a barium strontium titanate (BSTO) composite containing materials that enable low insertion loss and effective phase tuning at non-chilled temperatures, including room temperature;” None of the cited references disclose expressly or inherently “wherein the tunable dielectric layer comprises a barium strontium titanate (BSTO) composite containing materials that enable low insertion loss and effective phase tuning at non-chilled temperatures, including room temperature;”

Claim 1 has been modified to include the dielectric layer operates in the non-chilled (i.e. room temperature) range. Support for operating at room temperatures ranges (which is tantamount to non-chilled temperatures) can be found in line 16 of page 6. The Examiner has rejected claim 14 saying, “it would be obvious to use the materials recited in these claims in the device of Vandik et al. since they are well known ferroelectric material.” The Applicant respectfully disagrees that these materials would be obvious. In support of this, please find enclosed an affidavit from A.B. Kozyrev (one of the authors of the cited reference) stating that “one of the problems to overcome in the cited paper was the operation of Fin Line Phase Shifter with low insertion loss and effective phase tuning and increased life time under an elevated electric field and that the present invention, with the composite materials claimed in twice amended claim 1, overcomes these problems to operate with sufficient tunability at non-chilled temperatures, including room temperatures. Indeed, a number of times, the authors of the paper acknowledged that further research needed to be done in order to operate (i.e., provide sufficient

tunability) at non-chilled temperatures. For example, please see page 337, first paragraph, line 10, which states, "As for microwave applications of ferroelectric at room temperature, to-be-solved problems should be considered". Also, please see, the last paragraph of the conclusion, which states, "some problems concerning the physical phenomenon in ferroelectrics should be solved; that would provide new applications of ferroelectric components at microwaves." Indeed, the Applicant of the present invention has solved one of those problems (operating in the non-chilled temperature range, including room temperature) and has created a device using the tunable material that operates at room temperature: the WAVEGUIDE-FINLINE TUNABLE PHASE SHIFTER.

Further examples of the cited paper requiring the operation of the phase shifter at non-chilled temperatures include:

Page 325, paragraph 1, line 12: "With the development of high-temperature superconductor techniques, devices operating at liquid nitrogen temperature became more practical. As a result of the progress, the interest in FEs for electronically steerable components has been renewed." This implies, the topic of this paper is based on liquid nitrogen temperatures.

Page 326, column 2, paragraph 2.5, line 6: "The electrodes must be made from superconducting films."

Page 327, column 1, paragraph 4.3, line 14: "In order to develop the STO room temperature components for the microwave applications, the life cycle of STO thin film components under high applied voltage should be carefully investigated." The applicant has

carefully investigated these problems and has come up with solutions, such as the composite material that operates without chilling and at room temperatures as claimed in claim 1, to enable the present invention.

Page 336, table IV, entitled, "Possible Direction and Present State R&D in the Area of Ferroelectric Applications of Microwaves": Please note in the second column entitled, "Room Temperature, BSTO thin film structures, problem: high value of $\tan \delta$ ".

Page 336, paragraph 7, line 4: "That is followed by an elaboration of STO planar structures with the high QFTC which can provide the successful applications of such components at liquid nitrogen microwaves subsystems. At the same time, the interest to the microwave applications of ferroelectrics at room temperature still does exist." This implies that it would not be obvious to one of ordinary skill in the art to provide a composite such as claimed in claim 1 of the present invention, as at the time this article was written, no such solution existed and the authors noted that more research was needed; research that was provided by the present Applicant and in the present invention.

As the Applicant believes that the rejection of claim 1 has been traversed and claims 2 and 4 – 18 depend therefrom, these claims are believed to be traversed as well.

Accordingly, reconsideration and withdrawal of this rejection is respectfully requested.

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CONCLUSION

It is respectfully submitted that, in view of the foregoing amendment and remarks, the application is in clear condition for allowance. Reconsideration, withdrawal of all grounds of rejection, and issuance of a Notice of Allowance are earnestly solicited.

The Office is hereby authorized to charge any additional fees or credit any overpayments under 37 C.F.R. 1.16 or 1.17 to Deposit Account No. 50-2697. The Examiner is invited to contact the undersigned at 202-607-4607 to discuss any matter regarding this application.

Respectfully submitted,

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APPENDIX

Marked-up Paragraphs and Claims Showing the Changes Made by Amendment

IN THE CLAIMS:

The claims have been amended as follows:

1. A device comprising;
a waveguide;
a finline substrate positioned within the waveguide;
a tunable dielectric layer positioned on the finline substrate, wherein the tunable dielectric layer comprises a barium strontium titanate (BSTO) composite containing materials that enable low insertion loss and effective phase tuning at non-chilled temperatures, including room temperature;
a first conductor positioned on the tunable dielectric layer; and
a second conductor positioned on the tunable dielectric layer, the first and second conductors being separated to form a gap having a minimum width ranging from 2 micron to 50 micron.
2. The device according to claim 1, wherein:

the gap extends from a first end of the tunable dielectric layer to a second end of the tunable dielectric layer;

the gap includes a first end, a center portion and a second end; and

the gap includes exponentially tapered portions adjacent to said first and second ends.

3. (Cancelled) A tunable phase shifter according to claim 2, wherein the gap has a minimum width ranging from 2 micron to 50 micron.

4. The device according to claim 1, further comprising:

a voltage source for applying a control voltage between the first conductor and the second conductor.

5. The device according to claim 1, wherein the second conductor forms an RF ground.

6. The device according to claim 1, wherein the second conductor comprises:
an RF choke.

7. The device according to claim 1, wherein the waveguide includes first and second

sections, and the tunable phase shifter further comprises:

a first conductive plate positioned between the first and second sections of the waveguide; and

a second conductive plate positioned between the first and second sections of the waveguide, the first conductive plate being insulated from the waveguide and the second conductive plate being electrically connected to the waveguide.

8. The device according to claim 7, further comprising an impedance matching section formed by a gap between the first and second conductive plates.

9. The device according to claim 8, wherein the impedance matching section comprises:

an exponentially tapered gap between the first and second conductive plates.

10. The device according to claim 1, wherein:

the first conductor is insulated from the waveguide and includes an RF ground;

and

the second conductor is electrically connected to the waveguide.

11. The device according to claim 10, further comprising an impedance matching

section formed by a gap between the first and second conductors.

12. The device according to claim 11, wherein the impedance matching section comprises:

an exponentially tapered gap between the first and second conductors.

13. The device according to claim 1, wherein the tunable dielectric layer comprises a material selected from the group of:

barium strontium titanate, barium calcium titanate, lead zirconium titanate, lead lanthanum zirconium titanate, lead titanate, barium calcium zirconium titanate, sodium nitrate, KNbO_3 , LiNbO_3 , LiTaO_3 , PbNb_2O_6 , PbTa_2O_6 , $\text{KSr}(\text{NbO}_3)$, $\text{NaBa}_2(\text{NbO}_3)_5$, KH_2PO_4 , and combinations thereof.

14. The device according to claim 1, wherein the tunable dielectric layer comprises a barium strontium titanate (BSTO) composite selected from the group of:

BSTO-MgO, BSTO-MgAl₂O₄, BSTO-CaTiO₃, BSTO-MgTiO₃, BSTO-MgSrZrTiO₆, and combinations thereof.

15. The device according to claim 1, wherein the tunable dielectric layer comprises a material selected from the group of:

Mg₂SiO₄, CaSiO₃, BaSiO₃, SrSiO₃, Na₂SiO₃, NaSiO₃·5H₂O, LiAlSiO₄, Li₂SiO₃,
✓ Li₄SiO₄, Al₂Si₂O₇, ZrSiO₄, KAlSi₃O₈, NaAlSi₃O₈, CaAl₂Si₂O₈, CaMgSi₂O₆, BaTiSi₃O₉
and Zn₂SiO₄.

16. The device according to claim 1, wherein the tunable dielectric layer comprises:
an electronically tunable dielectric phase and at least two metal oxide phases.

17. The device according to claim 1, wherein the tunable dielectric layer has a
dielectric constant at zero bias voltage ranging from 30 to 2000.

18. The device according to claim 1, wherein the a finline substrate comprises:
a low loss, low dielectric material.